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SMALL-POX AND VACCINATION.*

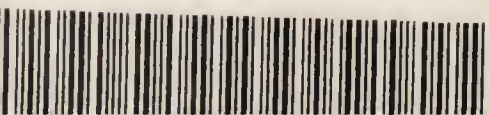
R. Harvey

THE subject which the Public Health Society has commissioned me to deal with this evening is not only most interesting and important in itself, but gives us the best possible example of the beneficent effects of medical science in the prevention of disease; and by showing us what science has done in checking one terrible malady, gives us a lively hope of future triumphs over others. Last year I showed you how, under the generally improved conditions in which European nations at least now live, plague has disappeared from that Continent; this evening I shall relate how the force of a strong intellect interrogating nature by strictly scientific methods, wrested from her the means of controlling another malady scarcely less dreadful than the plague. I shall have to show you also how the prejudices and carelessness of mankind have limited, to some extent, the benefit conferred by Jenner's immortal discovery, and point out in conclusion the practical bearings of the whole subject, on the prevention of small-pox in Calcutta. You know how proverbially "doctors differ," and I may say with Sheridan, "when they do agree their unanimity is wonderful." Now there is nothing more wonderful than the practically complete unanimity not only of the whole medical profession everywhere, but of all who have examined the subject and know anything of the evidence, as to the value of vaccination as a preventive and modifier of small-pox. The general public as a body knows, however, but little of the evidence, and while accepting vaccination on the authority of the profession, and because it is prescribed by

* A lecture delivered on Friday, the 26th February 1886, by Robert Harvey, Esq., M.D., at the Wesleyan School House.

law, is liable to be unduly influenced by noisy declamation and confident assertions which it has not the power to disprove. I propose to give you such a sketch of the evidence as will convince you both of the enormous value of vaccination, and of the folly of refusing the safeguard which it gives. We must begin, however, by glancing briefly at small-pox, and seeing the character and extent of the danger from which vaccination offers us a way of escape.

I have not time to go deeply into its history. The origin of the disease, like the origin of life, is a problem insoluble by reason, but there are the strongest grounds for believing that it is never now spontaneously generated, and that every case is produced directly from a previous case. The seeds are contained in the matter of the eruption, and can be implanted with the lancet from person to person. They can also be conveyed through the air, by articles of clothing, and also in the breath of those affected. There is reason to believe also that the germs can retain their vitality for a considerable, probably an indefinite, period, while the conditions for their development are unfavourable, and spring into active life as soon as the conditions become favourable. Most authorities put the date of the first authentic outbreak of the disease as the sixth century A.D., and make Rhazes, the celebrated Arabian physician, the first describer of it. An Ethiopian army besieging Mecca was so severely attacked by the disease that the siege had to be raised. There can be little doubt, however, that it has been known in China from time immemorial, and authentic records trace it back to the Tchow Dynasty 1122 B.C. There is also a curious passage in the life of Moses by Philo of Alexandria, written early in the first century, describing purulent pustules of a confluent character spread over the whole skin, a most faithful description of small-pox, which, if correct, takes us back to 1500 years before Christ, or at least to the first century, when it was written. It must suffice to say, however, that once introduced into any country, it has speedily become a permanent resident, and has done more than almost any other pestilence—more probably than the plague itself, since it flourishes in all countries and under all climatic conditions—to embitter human life and carry off redundant population. “It is one of the channels,” says Malthus in his essay on population, “and a very broad one, which nature has opened,” to keep society from pressing too closely on the means of subsistence. For in its natural state it is at



once the most common, the most repulsive, and one of the most fatal of diseases—facts which we in our comparative ignorance of it are apt to forget. So common was it in the prevaccination days that almost every one had to pass through it, just as almost every one has still to go through measles, chicken-pox, whooping cough, and other childish diseases, so called not because adults are not liable to them, but because most people contract them as children, and they all have the fortunate peculiarity that they do not as a rule attack the same person a second time. Here, in India, where vaccination is backward, we find that in districts where inoculation is not practised, almost every one has had small-pox as a child.

In a terrible epidemic of small-pox which occurred in India in 1868-69, and of which I published an account, it was found that only 2·18 per cent. of those attacked in Agra were over ten years of age, and only 2·24 in Bharatpur. This proves not that adults are not liable to the disease, but, as pointed out by Simon, that “all who have outlived the first years of childhood have probably had their susceptibility exhausted by suffering the disease.” At Arrah in 1865 I found 96 per cent. of the prisoners had had small-pox either naturally or by inoculation, and in the Alwar Jail every one of 213 prisoners was distinctly pitted by the natural disease. Duvillard found that in Europe, before the discovery of vaccination, scarcely 4 per cent. of persons 30 years of age had escaped an attack, and Villiex says of the same period that few individuals escaped small-pox. Descriptive rolls of escaped prisoners, or of persons wanted in the “Hue and Cry,” almost invariably note that they are pitted, much pitted, or have lost an eye from small-pox, and the literature of the time is full of allusions to the much-dreaded disease. There was hardly a family that had not suffered from its ravages, and in that of Lord Petre it had claimed 18 victims in 27 years. So much for the commonness of its occurrence. Of its loathsomeness I will say little. Those who have seen a case of confluent small-pox know that few earthly ills can approach it; to those who have not seen it, I can only say I hope they never may. Macaulay calls it the most terrible of all the ministers of death, “turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover.” Its fatality may be roughly taken at 25 per cent., or 1 in 4 of those attacked, but it varies in

different epidemics, has been as low as 1 in 7, and as high as 1 in 2. The experience of the London Small-pox Hospital over a long series of years gives a death-rate of 37 per cent., more than 1 in 3. When cases are few and far between the mortality is comparatively low, when the disease is epidemic and the poison consequently multiplied, it is also intensified in virulence, and the mortality is high. It is when it gets into a new country, however, where no part of the population is protected, that its ravages are worst, and history gives many melancholy illustrations of this. Thus Washington Irving relates that after the conquest of Syria by the Arabs 638 A.D. "great numbers of the people perished, and with them twenty-five thousand of their Arabian conquerors, so that the eighteenth year of the Hejira became designated as the year of mortality." The disease was introduced into Mexico, according to Prescott, by a Negro slave in the fleet of Narvaez in 1520. "Cuitlahuac, the successor of Montezuma, was one of its first victims, and it spread rapidly over the whole country leaving its path strewn with the dead bodies of the natives, who perished in heaps like cattle stricken with the Murrain." And again he says that it "swept over the land like fire over the prairies, smiting down prince and peasant, and adding another to the long train of woes that followed the march of the white man." An ancient manuscript found in the Cathedral of Quito by de la Condamine relates how small-pox was introduced into Peru *viâ* Carthagena 50 years after the discovery of the country, and killed 100,000 Indians in the single province of Quito. The same authority says it was fatal to almost all the natives in the Portuguese Settlements along the Amazon. Cook in his voyages tells us that it was introduced into Kamskatka for the first time in 1767 and killed 20,000 people, leaving whole villages nearly desolate. Cranz in his history of Greenland, that it "almost depopulated" that country when first introduced in 1733. In 1793 it was carried to the Isle of France by a Dutch ship and caused 5,400 deaths in six weeks.

In 1789 it appeared for the first time in New South Wales. "The desolation which it occasioned," says Malthus, "was almost incredible. Not a living person was to be found in the bays and harbours that had been before the most frequented. Not a vestige of a human foot was to be traced on the sands. They had left the dead to bury the dead. The excavations in the rocks were filled with putrid bodies, and in many places the paths were covered with skeletons." Vancouver, in his voyage

along the north-west coast of America, traversed a hundred and fifty miles without seeing the same number of inhabitants, though deserted villages were frequent, each large enough to contain all the scattered savages that had been observed. Bruce says that it sometimes extinguishes whole tribes in Abyssinia, and I could occupy all the time at my disposal, in citing similar testimony to the universality and terrible severity of the scourge. One point I am anxious to impress on you, and that is that before the discovery of inoculation, indeed I may say that till the discovery of vaccination, the fear of small-pox was always present, everywhere. The disease itself might be absent, especially in isolated districts, for a few years, but the longer its absence, the more disastrous its re-invasion, and in some parts of the country it was constantly present,—sometimes in a less, sometimes in a more severe form, but always there, weighing like an incubus on every one who had not had it, and proving a constant source of terror to parents whose children had not yet been attacked. The report of the small-pox hospital for 1752 speaks of it as “a disease so frightful yet almost inevitable, which causes so much confusion in families. That to keep a servant ill with it is most dangerous and inconvenient; to thrust them out of doors is always inhuman and commonly fatal.” Baylis, in 1768, says of it that “so frequently it rages, so many and great are its dangers, and so certain is the catching it, that the dread of it alone makes many constantly miserable, and is the cause of their neglecting many important concerns.” Unfortunate patients, applying at the small-pox hospital for treatment, had to lodge sixteen shillings on admission, to provide for the cost of their too probable funeral. One other point I must touch upon, and that is that even when it fails to kill, small-pox frequently induces permanent ill effects which ruin the constitution, while they mar the beauty of the victims. Before the invention of vaccination three-fourths of the inmates of the Blind Asylum in the Borough owed their loss of sight to small-pox; and deafness, lameness, scrofula, and general ill-health were frequent consequences. Servants and others who had not undergone the disease were frequently refused places, lest they should inconvenience their employers by catching it.

Such is the natural small-pox, and we cannot wonder that it was looked on with terror and with dread, or that a people accustomed to its ravages should hail with acclamation any method which offered an escape from it. The relief first offered was

inoculation—a process in which the poison of small-pox is deliberately introduced under the skin with a lancet on purpose to produce the disease, it having been found that, when so contracted, small-pox is infinitely less severe and dangerous than when caught in the ordinary way. This method of sewing the small-pox has been known for centuries to the Chinese, and had found its way in process of time across the Central Asian deserts to Circassia, where it was eagerly adopted as a means of preserving the beauty—and market value—of the women. From Circassia it was brought to Turkey about 1673 by an old Thessalian woman, and was received by the Christian subjects of the Porte as a direct revelation from the Virgin, while the operation was considered more likely to be successful if the pustules were arranged in the form of a cross. The custom became almost universal, yet so small was the international intercourse in those days that forty years lapsed before we find the plan so much as noticed in Western Europe, and fifty years before it began to be practised. In 1713 M. Timoni, a physician in Constantinople, sent a note about it to Dr. Woodward, of London, who brought it to the notice of the Royal Society, but no action was taken and no one was inoculated. In 1715 one Jacobo Pylarini published in Venice, *superiorum permissu*, a Latin tractate dedicated to the British Consul at Smyrna, in which is a graphic description of the process. This also seems to have led to no action, and it is to Lady Mary Wortley Montague, wife of our ambassador at Constantinople, that the introduction of the practice into Western Europe is due. In 1721, in spite of the disapproval of her chaplain and the objections of the Court physicians, she had two of her own children inoculated, and had sufficient influence to make the practice fashionable. In July 1821, four malefactors, under sentence of death, were offered inoculation as an alternative, accepted it, recovered, and saved their lives ; and in the course of a few years the practice became general among the upper classes, the greatly diminished risk making people very ready to accept the certainty of the inoculated instead of the almost equal certainty of at some time catching the infinitely more fatal natural disease. Like all innovations, however, it was not accepted without a good deal of opposition. Lady Mary was hooted as an unnatural mother who had voluntarily endangered the lives of her children ; the doctors were accused of favouring it for the fees which it brought them, though small-pox was

far more remunerative ; it was declared to be founded on atheism, quackery, and avarice, and one eminent divine, in a sermon at St. Andrew's, Holborn, in July 1722, declared that "by removing the fear of death, and as it will be readily granted there is no one thing so universally dreaded as small-pox, inoculation tends to promote vice and immorality ;"—a striking testimony at once to the destructiveness of the natural and the mildness of the inoculated disease. There is, however, one objection, and a fatal objection, to inoculation, and that is, that while conferring immense benefit on those who submit to it, it tends to spread the natural disease among those not inoculated ; for the inoculated disease, though mild and modified, is still small-pox, and each case of inoculation becomes a centre of infection from which unprotected persons may catch the natural unmodified disease. The consequence of this was that, while the death-rate in those inoculated sank to about 1 in 200, as against 1 in 4, the practice, by keeping small-pox everywhere present, led to an actual increase in the total number of deaths, an increase estimated by the great Dr. Heberden to have raised the small-pox death-rate from 74 per 1,000 of all deaths in the first thirty years of the eighteenth century to 96 per 1,000 in the last thirty. The practice, therefore, while a gain to the individuals inoculated, was a loss to the community at large, but the loss was largely due to the fact that no precautions were ever taken to prevent the inoculated from spreading infection. They commonly had the disease so mildly that they went about with the eruption on them, and were, indeed, required to attend at the inoculating stations, just as children are now required to attend after being vaccinated. Inoculation, therefore, was on the whole a curse instead of a blessing, and at the end of the eighteenth century small-pox stood fifth in order as a cause of death within the bills of mortality, and is believed to have been the cause of some 40,000 deaths annually in England alone.

From this melancholy state of things, vaccination has saved us, and for vaccination we are indebted to the genius of a country surgeon, the immortal Edward Jenner, a man imbued with the true philosophic spirit, modest and unassuming, patient in the investigation of nature, slow to form conclusions, ready to modify his views and submit them to every possible test before promulgating them, indifferent to misrepresentation and calumny, "serene and resolute and still, and calm and self-possessed." "I hope," he says, "that

the spirit with which this important enquiry will be prosecuted may be tempered with that calmness and moderation which should ever accompany philosophical researches." And, again : " Truth has ever been the object of my pursuit, and should it appear that I have been led into error, fond as I may appear of the offspring of my labours, I had rather see it perish at once than exist and do a public injury." We shall see presently with what calmness and moderation the opposition to vaccination was conducted.

Jenner was the son of the Revd. Stephen Jenner, Rector of Rockhampton and Vicar of Berkeley, Gloucester. He was born on the 17th May 1749, and educated at Cirencester. His medical education was begun, as was the fashion of those days, under Mr. Dan Ludlow, a surgeon of Sudbury, and finished in London, where he was the favourite pupil of the great John Hunter. He early developed a taste for natural history, especially ornithology, and was offered the post of Naturalist in the expedition of Captain Cook and Sir Joseph Banks. This, however, he declined, as he did also the offer of a good appointment in India, because he did not wish to be separated from his brother. As early as 1768 the germ idea, which afterwards blossomed into vaccination, was implanted in his mind by the remark of a milkmaid that she could not take small-pox as she had had cow-pox. On enquiry he found that there was a general impression among the milkers attached to the dairies in the county that a disease, the cow-pox, which they were in the habit of contracting in the operation of milking, was a preventive of small-pox ; and further prolonged enquiries convinced him that the impression was correct. The subject was, however, beset with many difficulties—difficulties which would have quenched the ardour of any ordinary man, and which took him thirty years to overcome. In 1775, for instance, there was a bad epidemic of small-pox, and many persons were inoculated in consequence. He found that in many cases the operation failed to produce small-pox, and that all these persons had had cow-pox. He found, however, that many others who believed they had had cow-pox took small-pox. This led him to investigate the diseases of the cow, and at length he discovered that there were several vaccine diseases communicable to man, only one of which conferred protection against small-pox. Continuing his investigations he found that some persons who had been inoculated with the real cow-pox were still liable to small-pox.

This was a heavy blow and sore discouragement, and led him to believe for a time that he had been mistaken. Further observation, however, taught him that the genuine cow-pox was protective only at a certain stage of its progress, and that though still capable of producing sores it lost its specific protective effect after a time. He had now worked out his theory, and had conceived as early as 1780 the happy thought that the cow-pox might be transmitted direct from one human being to another. It remained to put the theory to the decisive test of experiment. This was done by inoculating a boy named Phipps with cow-pox matter taken direct from the cow. The disease—vaccinia—was communicated, and ran its regular course, and from the boy others were vaccinated, and others again from them, all taking successfully, and proving the possibility of transmitting cow-pox from man to man. Remained the great question, Did it preserve them from small-pox? One crucial experiment remained: to expose them to the virus of small-pox. If they resisted it the induction was sound, and the dream of years, that a remedy had been discovered which would banish from the world one of its worst plagues, would become a magnificent reality. It is difficult to imagine what Jenner's feelings must have been as he approached his final experiment. Success—immortal honour and enormous good to mankind if the patients resisted the infection; the crumbling away of thirty years of fruitless labour, if they developed small-pox.

All the cases were inoculated with small-pox, and all came triumphantly through the ordeal. The small-pox poison was powerless to hurt them; they were protected by the vaccination. "It is rarely," says Lettsom, "that genius, however distinguished, is so accurate as to give a first essay without omission or redundancy. Jenner gave not only a perfect outline, but every tint of light and shade." For beyond one small mistake, which he soon acknowledged, as to the origin of the cow-pox, and a mistaken, though very natural, idea as to the absolute and permanent protection afforded in every case by vaccination, Jenner's observations have stood the test of nearly ninety years' experience, and are as true now all over the world as when he first published them. This he did in 1798. His claim was that in cow-pox we have a mild disease, which is never mortal, and seldom causes the smallest inconvenience, while it effectually prevents the most loathsome, highly infectious, and most fatal small-pox. Such a claim

at once arrested attention, and, although at first so astounding a revelation was received with natural distrust and scepticism by the profession, it could not be ignored, and the experiments were repeated on a large scale by many independent observers always with the same result. In 1800 Jenner published a second pamphlet in which he showed that more than 6,000 persons had been vaccinated, "and the far greater part of them since inoculated with small-pox, and exposed to its infection in every rational way that could be devised, without effect." The good news was everywhere hailed with acclamation, and within four years of the first promulgation of the theory the medical profession throughout the civilized world had become practically unanimous in favour of vaccination. This in spite of Lady Mary Montague's confident assertion that "small-pox is too beneficial to them not to expose to all their resentment the hardy Wight that should undertake to put an end to it." In 1803 the Medical Society of London unanimously voted Jenner a gold medal, and in 1804 Dr. Lettsom, President of the College of Physicians, made vaccination the subject of an oration, in which he spoke of it as a discovery unequalled in history, and raised a golden temple to the health-giving genius of Jenner. By 1800 vaccination was triumphant in France, and had been received with enthusiasm in Spain, Holland, Germany, Russia, and every European country. The Empress of Russia sent a diamond ring to Jenner, and conferred a pension for life on the first child vaccinated in Russia, and appropriately christened Vaccinoff. A Vaccination Mission was sent to carry it through the empire, even to Siberia and Kamskatka. Spain sent out an imperial expedition, which carried it to the Canaries and St. Helena, the Philippines, Macao, and Canton, and Central and South America. At Santa Fe the Viceroy and Archbishop went out with martial and religious pomp to meet the Mission, and 50,000 persons were soon vaccinated. Honours showered upon Jenner from all quarters, but the English College of Physicians with undue conservatism refused to admit him to the fellowship without examination. He declined to read up Greek and Latin. Would not do it for a diadem, that were nothing. Would not do it for John Hunter's museum. His biographer gives a charming picture of him at this time working quietly at home, with a temple of Hygeia in his Gloucestershire garden, where he vaccinated gratuitously the children of the poor. The whole subject was

investigated by a Committee of the House of Commons in 1802, and their report bears overwhelming testimony to the value of the discovery. On this the House voted £10,000 to Jenner, and again in 1807, £20,000 more on a report of the College of Physicians as to the complete success of vaccination, both grants passing "without even a symptom of controversial discussion,"—rewards which may receive our recognition as indications of a nation's gratitude, but surely insufficient. Had he destroyed as many thousands as he saved millions, his guerdon might have equalled that of Marlborough.

I have said that within four years of the publication of his first pamphlet vaccination had been accepted by the profession everywhere with practical unanimity. A few eccentric persons here and there, however, refused to be convinced, and made up in sound and fury for their inability to appreciate evidence; their opposition intensifying as evidence in favour of vaccination came pouring in on every side. As early as September 1798, Drs. Mosley and Rowley entered the lists against Jenner, and proved upon *à priori* grounds, for they neither of them ever vaccinated any one, that vaccination was a delusion and worse. Rowley, after stating that the most excellent physicians are always modest, candid, and unassuming, proceeds to declare Jenner and the other cow-poxers to be "infatuated visionists and daring projectors, and vaccination a criminal and murderous evil at the introduction of which earth trembled and heaven profusely shed tears." "Are men," he asks indignantly, "to become the victims of horrid beastly diseases, victims diseased for life, and transmit them to posterity for ages, that a few fanatics in science may revel in wealth? Forbid it heaven, forbid it humanity, forbid it justice, reason, and truth. It is enough to freeze the soul with horror." And again: "Cow-pox produced by presumptuous impious man is a daring and profane violation of our holy religion." Mosley early took up the notion that vaccination imparted to man the characteristics of the brute, and gravely describes a number of new and dreadful diseases due to vaccination, in which the bovine character was clearly traced. He tells us of the *facies bovillæ*, or ox face developed in children by vaccination, in which the nose becomes flattened and the front tauriform. He relates a case when long hair resembling that of a cow appeared on the vaccine scars. Other notices appeared of children that went on all fours, butted like bulls, coughed like cows,

or even grew horns, and portraits of the ox-faced boy were widely circulated. Moses was shown to have prohibited the horrid practice, and ordered such as followed it to be stoned. An earlier and scarce more happy Cuming proved to his own satisfaction that vaccination was denounced in prophecy, and that in the scars upon the arms we had the true mark of the beast. It was suggested that a new race would arise "*semibovemque virum, semivirumque bovem*" like the Minotaur. Reason, candour, honesty and courtesy speedily disappeared, abuse took the place of argument and the fight waxed fast and furious. An upholder of vaccination publishing a picture of Rowley as an old woman with horns, was asked what interest his family portraits could have for the public. Another was twitted with his ignorance of Latin, and a third triumphantly convicted of bad grammar. The Revd. Rowland Hill, who had taken up vaccination with enthusiasm, was addressed as the Revd. Rowland Hell, and thus apostrophised by Mosley:—"Rowland, I have bought your pamphlet. I paid a shilling for it. Rowland, it is not dear. The same quantity of folly, falsehood and impudence could not have been bought for twice the money of any other cow-poxer from the Ganges to the Mississippi."

In this, as in most controversies, there is generally something to be said for both sides. Now it need hardly be said that the pricking of an arm with a lancet is not vaccination. It is the maturation and due sequence of the disease vaccinia, which alone gives protection against small-pox, and a person who has been operated on without result stands in exactly the same position as regards liability to small pox, as if no attempt had been made to vaccinate him. Vaccination, too, if carelessly performed with dirty lancets, may bring on erysipelas; if done from an inflamed arm may produce a non-protecting sore, and may, sometimes, by the slight irritation which it causes, lead to the breaking out of latent disease. These facts were at first little understood, and the operation seemed so simple that all sorts of uninstructed persons "lady doctors, wrong-headed clergymen, needy and dependent medicasters and disorderly man-midwives," according to Mosley himself, had set up as vaccinators, in spite of Jenner's warning that no one without a particular and intimate acquaintance with the genuine vaccine pustule should venture to do so. The result was an immense amount of spurious vaccination, and as a natural consequence

a prejudice against the operation when people so vaccinated took small-pox as they very naturally did. To the public, too, Rowley, dating from Savile Row, and Mosley, physician to Chelsea Hospital, were greater authorities than a country surgeon like Jenner, and for many years England, the home of vaccination, was the worst vaccinated country in Europe.

The objections were partially silenced by the evidence given before the House of Commons in 1802, and practically extinguished for a time by the report of the Royal College of Physicians in 1807. These reports showed that, when properly performed, vaccination did all that Jenner claimed for it, and a writer in the *Edinburgh Review*, summing up the whole controversy, compares the anti-vaccinators to a few old Bailey pleaders and jobbing attorneys, and asks what their arguments are worth in opposition to the clear opinion of all the leading counsel and the unanimous judgment of the twelve judges. From this time vaccination was generally accepted in theory at least, but exaggerated notions of individual liberty prevented its establishment by law, and though a national vaccine board was established in 1805 and did its best to push vaccination, enormous numbers remained unvaccinated, and small-pox, though greatly checked, continued to kill large numbers every year. Experience, too, began to teach that Jenner had over-rated to some extent the endurance of the protective power of vaccination, and that while in the vast majority of persons a single effective operation did confer full, perfect and complete protection lasting for life, there remained a residuum relatively small, but absolutely sufficiently numerous, in whom the protection diminished or even occasionally disappeared in course of time. The analogy of small-pox would lead us to expect this, for while one attack does, as a general rule, protect from a second, exceptions are met with in every epidemic. It is now generally recognised that vaccination gives a less complete and lasting security than an attack of small-pox, but it has also been proved that, in re-vaccination, we have the means of renewing the protection; and also that when small-pox does occur in a well-vaccinated person it is, in the great majority of cases, so modified by the previous cow-pox, as to be diverted of most of its terrors and almost all its danger. For while the mortality from natural small-pox is one in four or five, the mortality from post-vaccinal small-pox is about 1 in 22, taking all cases together, and only about 1 in 200 in those

who have been thoroughly well done. In the epidemic at Bharatpur to which I have before alluded, each vaccinated child had, as compared with the unvaccinated, 24 chances to one of escaping small-pox altogether, and 128 to one that he did not die of it. The occurrence of small-pox after vaccination re-animated the drooping spirits of the opponents of the measure, and led to a re-investigation of the whole subject by a Select Committee of the House of Commons in 1833, their report confirming former evidence. In 1838, the Provincial Medical Society, alarmed by the continued presence of small-pox, again instituted an enquiry, which elicited the fact that the prevalence of the disease was due to a great neglect of vaccination, and led to the first Vaccination Act of 1840, by which increased provisions for public vaccination were made. A great diminution of small-pox followed, but there were still some 5,000 deaths a year throughout England, when in 1850 the Epidemiological Society went into the subject once more, and took the opinion of upwards of 2,000 medical practitioners as to the value of vaccination. "There was the utmost unanimity of expression respecting the existence of the protective power; and there was not a single practitioner who did not look on vaccination as a practice which ought to be universally adopted." In 1857, when the medical officer of the Privy Council (the late Sir J. Simon) presented an exhaustive report on vaccination to Parliament, it appeared that two only out of 539 of the leading medical authorities in Europe had any doubts as to the value of the practice. In 1853 and 1858 further enactments were passed, which recognised the principle of compulsory vaccination, but made very imperfect provision for it, and it was not till 1868 that an effective compulsory Act was passed for England, though such had been provided for Ireland and Scotland in 1863. Finally in 1871 a Special Committee investigated the subject once more, in consequence of the activity of the anti-vaccinationists having been renewed by the compelling clauses of the Act of 1868. The evidence taken by them fills 445 folio pages, and includes that of all the chief opponents of vaccination. The following are the conclusions of the Special Committee:—

I. That the cow-pox affords, if not an absolute yet a very great protection against an attack of small-pox; and an almost absolute protection against death from that disease.

II. That if the operation be performed with due regard to the health of the person vaccinated, and with proper precautions in obtaining and using the vaccine lymph, there need be no apprehension that vaccination will injure health or communicate any disease.

III. That small-pox unrelieved by vaccination is one of the most terrible and destructive of diseases, as regards the danger of infection, the proportion of deaths among those attacked, and the permanent injury to the survivors; and therefore

IV. That it is the duty of the State to endeavour to secure the careful vaccination of the whole population.

Numberless Commissions have also sat upon vaccination in every Continental country; and the result of every investigation has been to strengthen the evidence in favour of it. I must not, however, appeal to authority alone, though authority is still the basis of most popular beliefs. I will indicate very briefly some of the evidence on which authority rests. Take Sweden, where a Vaccination Act was passed in 1803. The table (Appendix No. I) gives a graphic idea at a single glance of what vaccination has done for that country. For the 27 years preceding vaccination the average annual small-pox mortality per million of population was 2,050, and reached 5, 6 and 7,000 in three epidemic years, while in 18 out of the 27 it was over 1,000, and only once under 500. In the first 54 years after vaccination the average had fallen to 158. The 1,000 has been reached but once, in 44 out of the 54 years it is below 500, in 17 less than 100, while in six there has been no small-pox mortality whatever. In the first eight years after the introduction of vaccination, but before it was universal, the rate is about 705. The law in Sweden permits, or till recently permitted, vaccination to be deferred up to two years of age. Were children done within three months of birth these splendid results would have been still better. In Copenhagen the average number of deaths from small-pox for the last 50 years of the eighteenth century was 248: from 1801 to 1810 it was 64. Since the introduction of compulsory vaccination in 1810 it has been only 23, though the population has doubled. For 13 years after the passing of the compulsory Act there was not a single death from small-pox. It had never been absent for 60 years before. The next table (Appendix No. II) compiled by Mr. Simon

from statistics officially furnished by the Governments concerned, shows similar results from all the territories whose statistics were sufficiently accurate to allow of exact comparison. The statistics as you see vary greatly, and the variation can be proved to depend on the quantity and quality of the vaccination in each country. As Simon says the figures show "that the fatality of small-pox in Copenhagen is but an eleventh of what it was ; in Sweden a little over a thirteenth ; in Berlin and in large parts of Austria but a twentieth ; and in Westphalia, but a twenty-fifth. In the last named instance there now die of small-pox but four persons, where formerly there died a hundred." The next table (No. III) shows the small-pox mortality of London in decennial periods from 1751, and illustrates the progressive decline of the disease as vaccination has become more and more general. The fourth table shows the effects of small-pox and vaccination on four different populations in India during the severe epidemic of 1868-69. In Agra, where at that time vaccination had made little way, the death-rate was 128 per ten thousand ; in Delhi, where some vaccination had been done, it was 104 ; in Bharatpur, where for some years it had been vigorously pushed, it was 65, and in the protected British army it was only $3\frac{1}{2}$.

I will not detain you longer over these somewhat dry figures, nor with examples of the protective power of vaccination from my own experience, though I could give many where vaccinated children escaped, though exposed to strong and virulent infection. We have seen that in the early days of vaccination large numbers were subjected to the crucial test of actual inoculation with small-pox without effect.

Yet in spite of all this evidence, opponents of vaccination are still met with ; and I must say a few words as to the modern views in opposition to it. Some are revivals of the oft-refuted *à priori* fallacies. Some are stark staring Bedlamite ravings. Thus one Edward Maitland, writing in 1877, says that the doctrine and method of orthodox science is "to ignore the divine vision and divine eyes of the sphinx, to hack and hew away every feature of it that does not correspond with its animal extremity, and to devote itself to the exclusive cultivation of the tail end of the beast." Others, again, are based on hearsay and newspaper paragraphs accepted without enquiry, and dishonestly persisted in after they have been disproved.

Thus Dr. Collins, the leading medical anti-vaccinationist, was not ashamed to admit before the Select Committee of 1871 that on newspaper report alone he had stated, in his pamphlet against vaccination, that 13 soldiers had died of vaccination at Shorncliffe, and others had had their arms amputated to save their lives, and that he had made no reference to the Medical Department of the Army to see whether the statement was true. It was absolutely and utterly false, yet is still frequently repeated. In some instances, however, the objections are quasi-scientific, and are based on statistics. Thus, it is shown that the decrease of small-pox has been followed by an increased death-rate from other diseases. As, however, vaccination does not profess to confer immortality, it is obvious that if people do not die of small-pox, they must die of something else, some time or other; while the Registrar-General's returns show a gradual diminution in the general death-rate, in other words, that the average age at death is increasing. Another theory is that the admittedly diminished mortality from small-pox is due, not to vaccination, but to a natural disappearance of the disease in consequence of generally improved health conditions. This argument, though plausible enough in England, is met by the fact that whenever small-pox appears among an unvaccinated community it shows all its old virulence. Thus in 1873 Consul-General Bulwer reports that an epidemic at Brunei in Borneo killed 4,000 out of a population of 35,000 in the course of a few months. My own experience in the epidemic of 1868-69 was that an enormous proportion of those unprotected either by vaccination or previous small-pox caught the disease, which finally died out for want of fresh victims for the virus to act upon. Indeed, the same fact was brought out in England itself in 1871-72, during the worst epidemic known for 30 years, when the disease was so severe that some 50 per cent. of the unvaccinated cases died, and the total small-pox deaths rose to 928 per million. The general results of this epidemic strengthened in every way the arguments for vaccination, and showed more clearly than ever the need that the vaccination should be of the best kind. Thus in the Merthyr Tydfil district the death-rate in the unvaccinated was 51.1 per cent., in those with one vaccine scar 8.5 per cent., with two scars, 6 per cent., with three 3.7 per cent., with four 1.5 per cent. Marson's experience in 32 years in the London Small-pox Hospital was very

similar. There died during the time 9 per cent. of the badly vaccinated, less than 2 per cent. with fairly good marks, and only .8 per cent. with standard marks. In the Poly-klinik at Leipzig during this same epidemic, 210 died out of 266 unvaccinated children; while of 117 who had been vaccinated, all recovered. Yet this epidemic furnished the anti-vaccinators with a very specious argument founded on figures. The returns showed that as nearly as possible half the cases which occurred were in persons who at some time or other had been vaccinated. What, they said, is the use of vaccination, if vaccinated and unvaccinated are equally liable to small-pox? This argument is exactly on all fours with Mark Twain's celebrated demonstration of the dangers of bed. The Erie Railway kills from 26 to 46 per million of its passengers, while 26,000 per million die in their beds in New York. "The danger is not in traveling by rail, but in trusting to those deadly beds. I will never sleep in a bed again." The fact that half the small-pox cases had been vaccinated, has to be taken in conjunction with the proportion of the vaccinated to the unvaccinated in the whole population. Now the Medical Officer of the Privy Council shows that some 97 per. cent. of the population of London has been vaccinated, and as the 3 or 4 per cent. of unvaccinated furnish half the cases of small-pox, it follows that as 4 is to 96, so is 1 to 24; in other words, the unvaccinated are 24 times more liable to small-pox than the vaccinated. It must be remembered, too, that a great deal of the vaccination in England was, until very recently, extremely bad, and that it is from the badly vaccinated class that most of, and the worst of, the post-vaccinal small-pox cases come.

By far the strongest argument against vaccination, however, is the allegation that it communicates or can communicate other diseases than cow-pox; in other words, that the lymph, if taken from a diseased vaccinifer, can convey his diseases. This objection was taken early, but for very many years was scouted by the profession as opposed to the experience of all its ablest and most experienced members. It was repeatedly shown by direct experiment that lymph taken from children suffering from all sorts of diseases communicated vaccinia and nothing else. Of late years, however, it has been shown that disease has occasionally been imparted by vaccination, but in every instance (and they can be almost counted on the fingers) the vaccination

has been either improperly performed by an uninstructed person or there has been strong reason to believe that the disease was already latent in the patient's system, and was only brought out, not given by vaccination.

This is the *post ergo propter* argument, that because one thing follows another it is caused by it. If one eats an egg at breakfast and breaks his leg afterwards, the most perverse logician would hardly ascribe the fracture to the egg, yet, if a baby develops any skin disease after vaccination, it is commonly ascribed to the vaccination, although skin diseases are exceedingly common among babies whether vaccinated or unvaccinated. Vaccination is thus often made a scape-goat, especially in those sad cases where the sins of the fathers are visited on the children, and very many cases of alleged post-vaccinal disease in children have been traced to this cause. It happens, fortunately for vaccination, that the disease usually breaks out before the vaccination has been done.

The strongest case on record of vaccine-conveyed disease is that in which one of the medical officers of the Board of Health succeeded in inoculating himself (after several failures), but he only succeeded because he disregarded two of the cardinal rules laid down by the National Vaccine Board, the chief of which is that no manifestly diseased child must ever be used as a source of lymph. The objection is recognized as so far valid that vaccination from the calf has been provided for any one who wishes to avoid the risk—a risk, however, which is so infinitesimal that it might well be disregarded. Were it a thousand times greater than it is, the danger from natural small-pox would still be infinitely greater. This was well put some years ago by a writer in the *Delhi Gazette*, who said of the man who, to avoid the chance of disease, refuses vaccination :—

Incidit in Scyllam cupiens vitare Charybdin—

“Only the Scylla of small-pox is a veritable Maelstrom, while the Charybdis of possible vaccine-conveyed disease is as the eddy caused in a half-empty cup by a revolving teaspoon.” Another objection is to the compulsory clauses of the Act, and the answer to this is *salus publica, suprema lex*. The public good is paramount, and, as Wilberforce pointed out long ago, “the liberty of individuals is infringed by Parliament in a thousand instances for the sake of promoting the interests of the

community at large." Still what Lowell calls "the right divine of every man to do as he d—d pleases" has many advocates, especially in England and America, and it is probable that compulsory vaccination will always have enemies on this score.

I think I have now fulfilled my promise of proving to you the extreme value of vaccination, and the magnitude of the debt we owe to Jenner. Had his great discovery been utilized to the full, and with the precautions which he pointed out as necessary to complete success, we should have done far more to banish small-pox than has yet been done, but as it is its ravages have been to a great extent controlled, and its terrors mitigated.

Time warns me that I must omit a sketch of the progress of vaccination in India, and must confine myself to a few remarks on Calcutta vaccination in the past, and our requirements for the future. The last two tables show the small-pox mortality, as far as I can trace it, and the vaccine operations for the last ten years. If we take the 34 years for which we have figures previous to the stopping of inoculation in 1865, we find the annual average deaths from small-pox were 722, while in the last twenty years they have been only 235, and this in spite of the fact that vaccination in Calcutta, though very good in quality, is very insufficient in quantity. Thus in the nine years, 1876-85, omitting 1878 for which I have not figures, only 25,548 children were vaccinated under one year old out of 64,799 born alive, so that we have at all times a large amount of material for small-pox to work on, and although we have had a compulsory vaccination law since 1880, the Vaccine Department has not yet succeeded in enforcing it thoroughly. In 1884, in spite of the presence of an epidemic of small-pox, it only succeeded in accounting for 4,365 out of 7,728 children born alive, and last year for 5,179 out of 7,845. No one who knows as I do the magnificent work performed by the Calcutta vaccinators since they were organized by Dr. Charles, after the terrible epidemic of 1865, will blame them for this. The wonder is not that they have not done more, but that they have done so much. For the prejudices of large classes of the community against vaccination as a new fangled innovation contrary to the customs of caste are still great, registration of births is not quite perfect, and the population of Calcutta is, to a large extent, migratory, while large numbers of children die in their first year before

the vaccinators have caught them. Great numbers of unvaccinated children also flock in every year from the provinces, and the law gives very imperfect power for ensuring their vaccination, while their discovery is a matter of chance. In this way there is always a considerable unprotected population among which small-pox can spread whenever it gains a footing. That it does get a footing now and then still, is shown by the epidemic of 1878-79, which carried off 2,267 victims, and by that of 1884-85 which killed 633. That it does not do more harm is due to vaccination, and this was very strikingly shown in 1870 when an epidemic was due, began in the usual way, and was nipped in the bud by energetic vaccination after causing only 151 deaths. Contrast these figures with those of the pre-vaccination period, for there was no really efficient vaccine establishment till 1865. The epidemic of 1832-33 killed 3,227; that of 1837-38, 1,773; that of 1843-44, 3,176; that of 1849-50, 6,154; that of 1856-57, 3,355; and that of 1864-65, 5,556. Terrible as these figures are, there is strong reason to believe that they are much under the truth, for registration was exceedingly imperfect, and many deaths probably escaped notice. We see, then, that figures teach us the same lesson in Calcutta as elsewhere as to the value of vaccination, and I have great hopes that the amendments in the law now before the Legislative Council will, if passed, do much to improve the protection of the city, although it will probably be many years before ignorance and apathy and active opposition change into appreciation and allow of the complete protection of our people.

And now, ladies and gentlemen, I have done. I fear I have severely taxed your patience. But my task has not been easy. I have had to compress into one lecture, the essence of many ponderous tomes. I have had to try to instruct you without being dull, to be brief at the risk of becoming obscure, to turn, as Shakespeare says, "the accomplishment of many years into an hour glass." No one can be more aware than I am of the inadequate justice I have done to my subject, but I trust I have at least satisfied all of you that in vaccination we have an inestimable benefit which it is not only unwise, but, as *Punch* pointed out long ago, wicked to neglect.

II.—Statement showing Small-pox Mortality before and after introduction of Vaccination in various European Countries.

From the Parliamentary Blue Book, 1857.

Terms of years respecting which particulars are given.	Territory.	APPROXIMATE AVERAGE ANNUAL DEATH-RATE BY SMALL-POX PER MILLION OF LIVING POPULATION.	
		Before introduction of Vaccination.	After introduction of Vaccination.
1777—1806 and 1807—50 ...	Austria, Lower ...	2,484	340
1777—1806 „ 1807—50 ...	Ditto, Upper, and Saltz- bury ...	1,421	501
1777—1806 „ 1807—50 ...	Styria ...	1,052	446
1777—1806 „ 1807—50 ...	Illyria ...	518	244
1777—1806 „ 1807—50 ...	Trieste ..	14,046	182
1777—1803 „ 1807—50 ...	Tyrol and Voralberg ...	911	170
1777—1806 „ 1807—50 ...	Bohemia ...	2,174	215
1777—1806 „ 1807—50 ...	Moravia ...	5,402	255
1777—1806 „ 1807—50 ...	Silesia (Austrian) ...	5,812	198
1777—1806 „ 1807—50 ...	Gallicia ...	1,194	676
1787—1806 „ 1807—50 ...	Bukowina ...	3,527	516
1776—1780 „ 1810—50 ..	Prussia (Eastern Pro- vinces) ...	3,221	556
1780 „ 1810—50 ...	Ditto (Western Pro- vinces) ...	2,272	356
1780 „ 1816—50 ...	Posen ...	1,911	743
1776—1780 „ 1810—50 ...	Brandenburgh ...	2,181	181
1776—1780 „ 1816—50 ...	Westphalia ...	2,643	114
1776—1780 „ 1816—50 ...	Rhenish Provinces ...	908	90
1781—1805 „ 1810—50 ...	Berlin ...	3,422	176
1776—1780 „ 1816—50 ...	Saxony (Prussian) ...	719	170
1780 „ 1810—50 ...	Pomerania ...	1,774	130
1774—1801 „ 1810—50 ...	Sweden ...	2,050	158
1751—1800 „ 1801—50 ...	Copenhagen ...	3,128	286

III.—Small-pox Mortality in London.

From Seaton's Hand-book of Vaccination.

Periods.	AVERAGE ANNUAL DEATHS.		Small-pox deaths per 1,000 deaths from all causes.
	All Causes.	Small-pox.	
1751—60	20,872	2,061	100
1761—70	23,202	2,445	108
1771—80	22,404	2,204	98
1781—90	19,516	1,705	87
1791—1800	20,213	1,780	88
1801—10	19,582	1,253	64
1811—20	18,604	793	42
1821—30	21,645	699	32
1831—40	24,585	573	23
1841—50	52,217	841	16
1851—60	61,047	715	11

IV.—Incidence of Small-pox on different populations in India, 1868-69.

Parliamentary Blue Book, 1871.

	Population or Strength.	Cases of Small-pox.	Deaths from Small-pox.	RATIOS PER 10,000	
				Cases.	Deaths.
AGRA.— <i>Virtually unprotected</i> ...	142,661	9,898*	1,836†	693·81*	128·69†
DELHI.— <i>Less unprotected</i> ...	154,417	8,688*	1,612†	562·67*	104·39†
BHARATPUR.— <i>Partially protected</i> ...	61,448	2,162	401	351·84	65·25
BRITISH ARMY.— <i>Protected</i> ...	33,350	145	12	43·47	3·59

* Estimated.

† Actual.

V.—Statement showing the small-pox deaths of Calcutta for 34 years before, and 20 years after, the prohibition of inoculation and re-organization of the Vaccine Department.

BEFORE RE-ORGANIZATION OF VACCINE DEPARTMENT.				SINCE RE-ORGANIZATION OF VACCINE DEPARTMENT		REMARKS.
Year.	Deaths from small-pox.	Year.	Deaths from small-pox.	Year.	Deaths from small-pox.	
1832	679	1852	59	1866	83	Inoculation for small-pox was prohibited, and the Vaccine Establishment re-organized on its present footing in consequence of the severe epidemic of 1865.
1833	2,548	1853	19	1867	35	
1834	36	1854	113	1868	43	
1835	53	1855	61	1869	39	
1836	16	1856	178	1870	151	
1837	266	1857	3,177	1871	32	
1838	1,507	1858	123	1872	18	
1839	81	1859	54	1873	34	
1840	22	1860	64	1874	125	
1841	56	1861	58	1875	782	
1842	25	1862	48	1876	71	
1843	336	1863	100	1877	67	
1844	2,840	1864	633	1878	1,495	
1845	67	1865	4,923	1879	772	
1846	78			1880	114	
1847	33			1881	133	
1848	107			1882	17	
1849	1,724			1883	73	
1850	4,430			1884	478	
1851	32			1885	155	
		Total...	24,542	Total...	4,717	
		Average	722	Average	235	

VI.—Statement showing Registered Births (excluding still births), and Vaccinations in Calcutta since 1876.

Year.	Births registered	VACCINATIONS.			Percentage of children born, vaccinated within the year.
		Under 1 year.	Over 1 year.	Total.	
1876	7,452	1,888	4,198	6,086	25·60
1877	7,457	1,846	4,265	6,111	24·76
1878	6,925	14,569
1879	6,409	3,007	6,904	9,911	46·92
1880	7,055	2,408	2,941	5,349	34·13
1881	6,954	2,108	3,415	5,523	30·31
1882	7,006	2,393	4,880	7,273	34·15
1883	6,093	2,354	6,295	8,649	34·15
1884	7,728	4,365	9,206	13,571	56·48
1885	8,355	5,179	7,278	12,457	61·98

